

# Overview

## Tank Automotive Research, Development & Engineering Center

### Mr. Chuck Coutteau, Associate Director Ground Vehicle Power & Mobility

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- Provides full life-cycle engineering support and is provider-of-first-choice for all DOD ground combat and combat support vehicle systems.**
- Develops and integrates the right technology solutions to improve Current Force effectiveness and provide superior capabilities for the Future Force.**

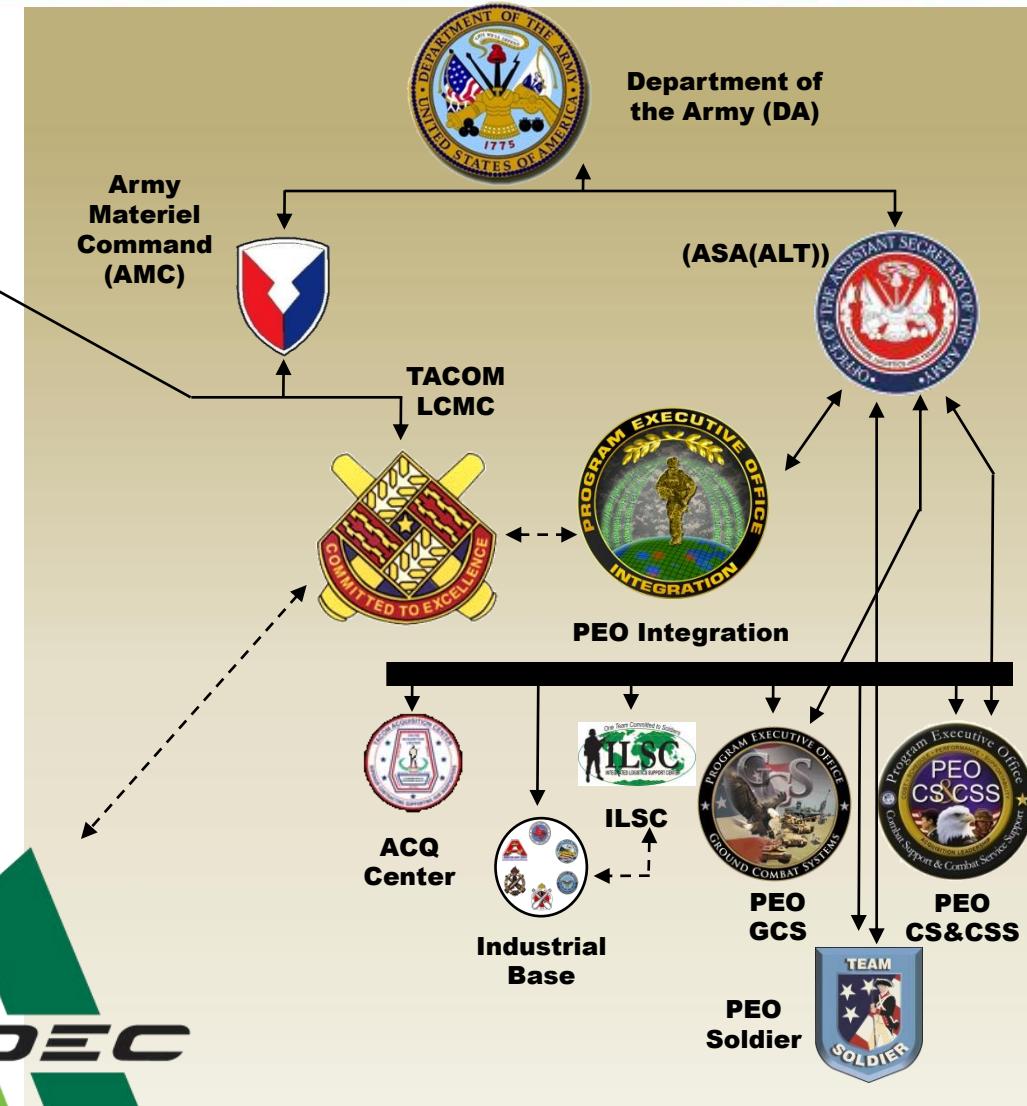
***Ground Systems Integrator  
for the Department of Defense***



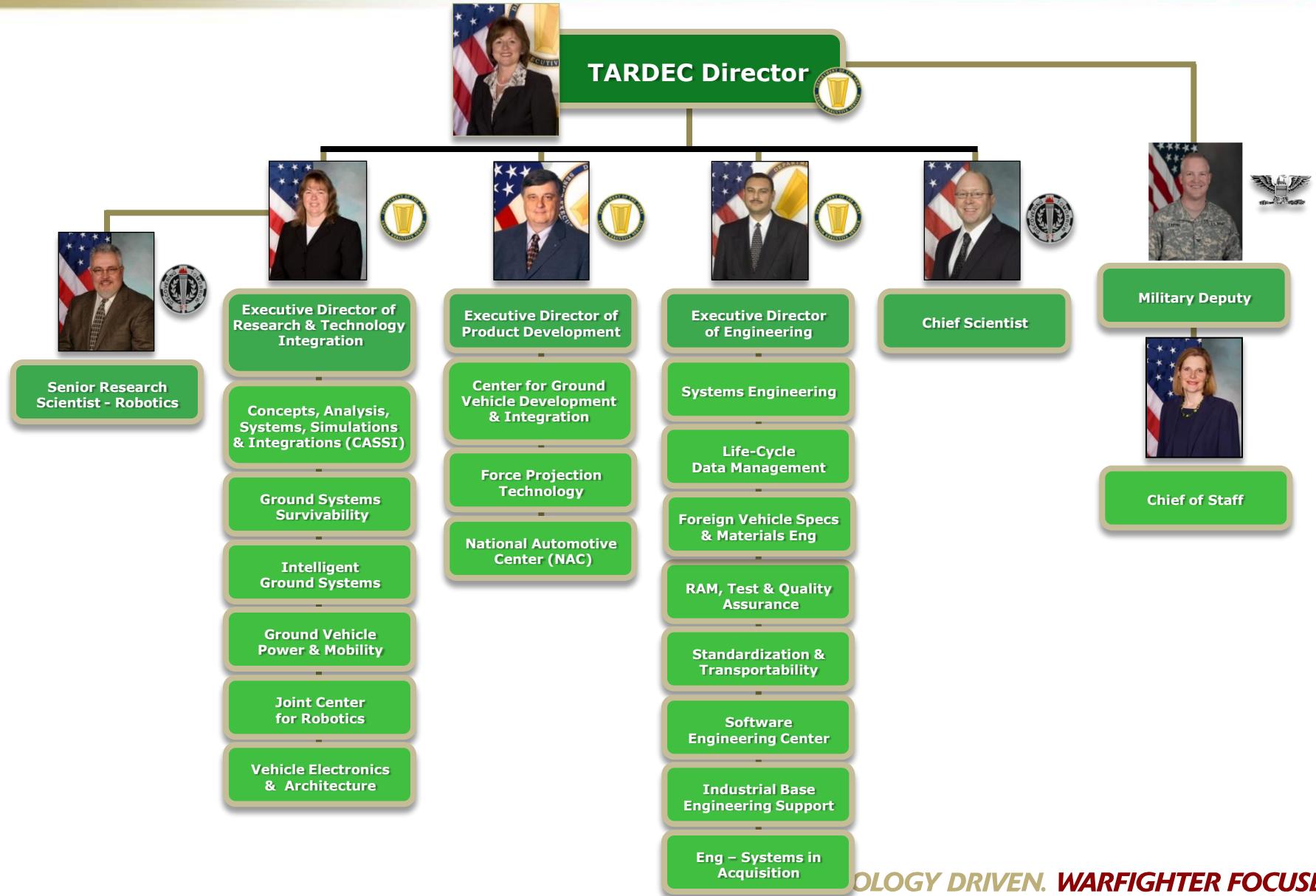
**Responsible for Research, Development and Engineering Support to 2,800 Army systems and many of the Army's and DOD's Top Joint Warfighter Development Programs**

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

# Organizational Relationships



Reach back to over 8,500 Scientists and Engineers



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.



## Combat Vehicles

- Heavy Brigade Combat Team
- Strykers
- MRAPs
- Ground Combat Vehicles (Future)
- Abrams Main Battle Tank
- Bradley Fighting Vehicle



## Force Projection

- Fuel & Water Distribution
- Force Sustainment
- Construction Equipment
- Bridging
- Assured Mobility Systems



## Tactical Vehicles

- HMMWVs
- Trailers
- Heavy, Medium & Light Tactical Vehicles
- Joint Tactical Vehicle (Future)



## Robotics

- TALON
- PackBot
- MARCbot
- Gladiator
- Demonstrators
- Technology Components

**TARDEC Engineers Provide Cradle-To-Grave Engineering Support**

# Laboratory Capabilities

### System & Simulation Integration Laboratories

Concept Development	Modeling & Simulation Environment	System Evaluation	MRAP Systems Integration Lab
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### Survivability Laboratories

Ballistic Testing
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### Physical Simulation Laboratories

Reconfigurable N-Post Simulator	Multi-Axial Simulator	Vehicle Inertial Properties Evaluation Rig
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### Prototype Integration

Center for Ground Vehicle Development & Integration	Large Robotics Integration Cell
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### Fuels & Lubricants Laboratories

Coolant Lab	Grease & Hydraulic Fluid Lab	Fuel & Lube Lab	Analytical Lab
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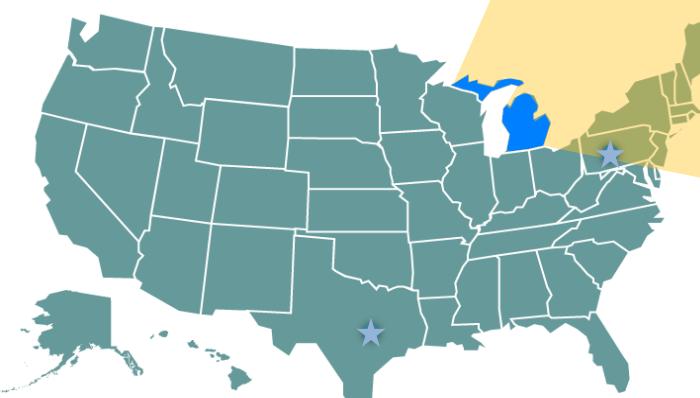
### Power & Energy Laboratories

Ground Systems Power & Energy Lab	Propulsion Laboratories
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**TARDEC's Warren, MI operations has a resource value of over \$950M and occupies 12 facilities on the Detroit Garrison totaling over 840,000 square feet of laboratory space**

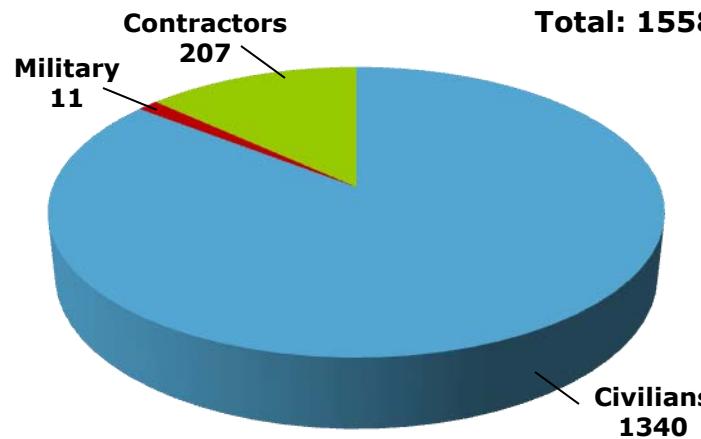
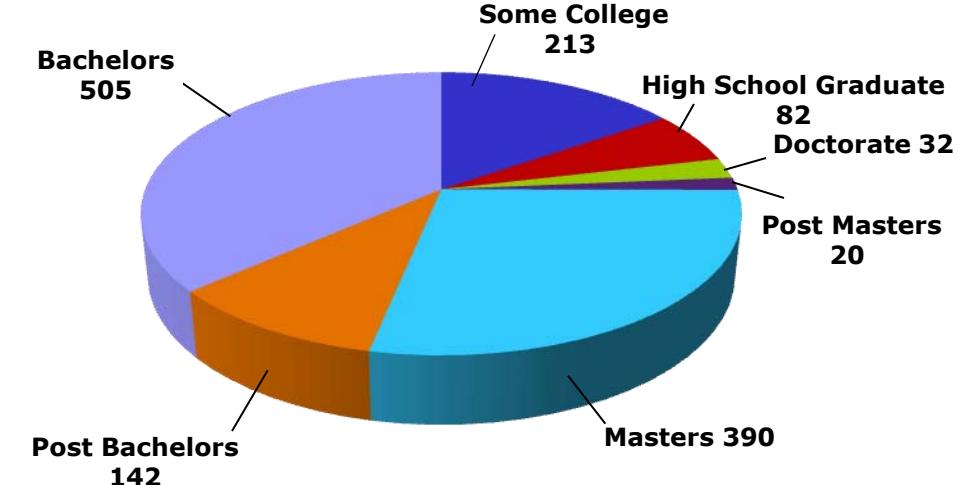
## Geographic Benefits

- Direct Linkage to World-Class Automotive Research and Development Centers
- Strategic Engagement with 2nd and 3rd Tier Automotive Supplier Network
- Connected to World-Class Universities



**Additional Facilities in  
Texas, & Pennsylvania**

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

**Total Workforce****Education****TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**



**Ground Vehicle Power & Mobility Integration**

- Prime Power (Powertrain)
- Non Primary Power
- Power & Thermal Management
- Energy Storage
- Track & Suspension
- Alternative Energy



**Ground Systems Survivability Integration**

- Integrated Vehicle Protection Systems
- Active Defense
- Signature Management
- Laser Vision Protection
- Ballistic Protection
- Crew Survivability



## Tactical Movement of Force Projection Technologies

- Water Generation, Purification, Storage, Distribution & Quality Surveillance (QS)
- Petroleum Storage, Distribution & QS
- Material Handling Equipment
- Mechanical Countermine Equipment
- Tactical Bridging

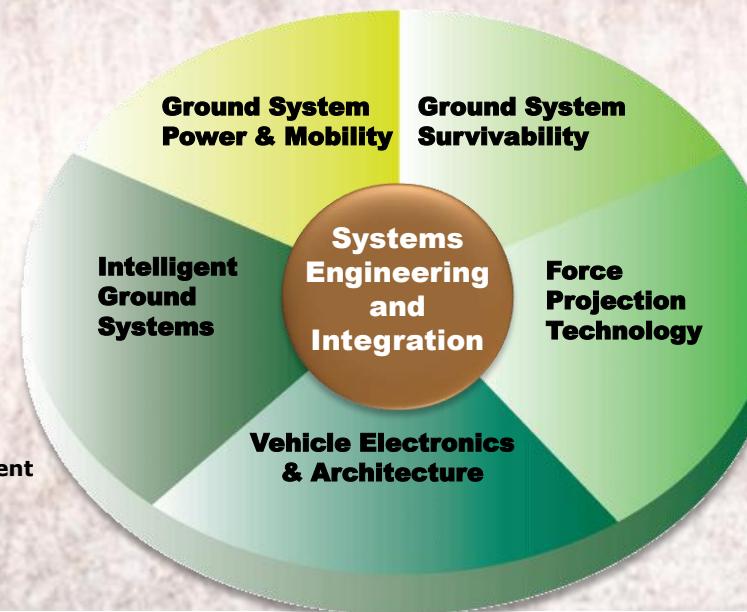
## Specification Development of Force Projection Technologies

- Petroleum, Oils & Lubricants Technology
- Alternative Fuels



## Intelligent Ground Systems

- Autonomous Robotics Systems
- Safe Operations Technologies
- Indirect Vision Technologies
- Unmanned Systems Technology Development
- 360° Situational Awareness Technologies
- Soldier Machine Interfaces
- Connected Vehicles



## Vehicle Electronics & Architecture Integration

- Electronics Integration
- Data Architecture
- Condition-Based Maintenance (CBM+)
- Power Architecture/Management

**Advanced Conceiving**

Future Force



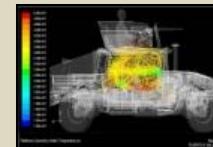
JLTV



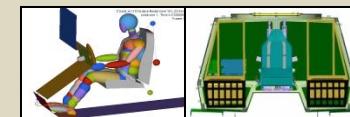
MRAP



FTTS

**Analytics**

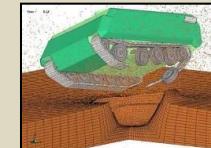
Thermal / CFD



Crew Safety



Structures/Durability



Blast

Dynamics

**Hardware & Man-In-The-Loop Simulation**

Characterization



Durability



Turret Testing



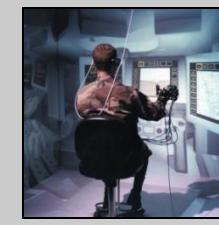
Human Dimension



Virtual Environments

**HPC & Data Management**

High Performance Computing (HPC)



Computer Aided Virtual Environment (CAVE)



FTTS



TWVS



FED



APD

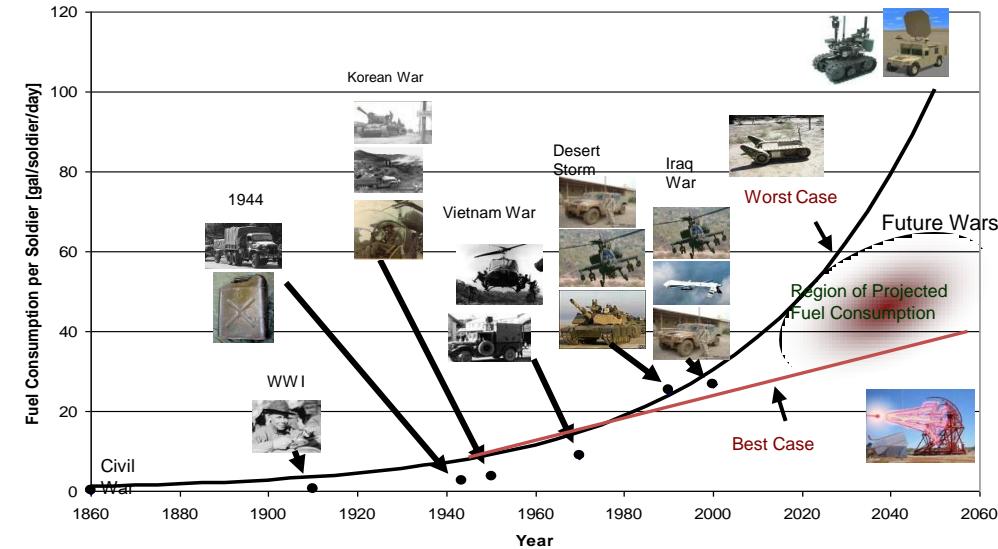


Advanced Collaborative Environment (ACE)

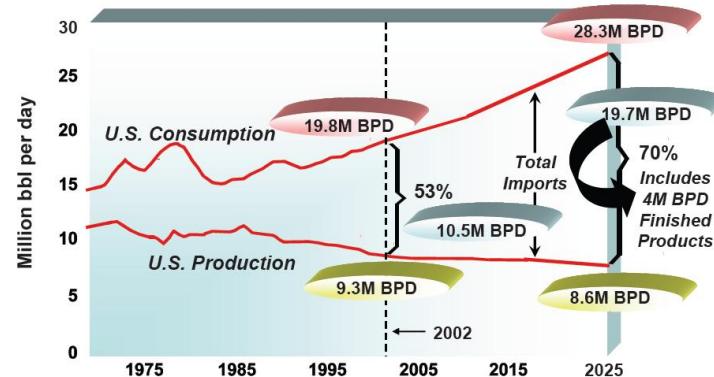
Providing rapid assessment and integration services throughout the Life Cycle of both Technology and System/Platform Development Programs.

## The Challenges

- Battlefield consumption of energy increasing
  - New C4ISR technologies
  - IED Defeat Systems
  - New weapons
- Energy security problematic
  - Increasing dependence on foreign oil
  - Alternative sources sought – wind, solar, biomass, waste to energy
- Operational issues
  - Battery usage & limitations – energy & power density
  - Demand for auxiliary power on-board vehicles
  - Emphasis on silent (“quiet”) watch
  - Unmanned vehicles (air/ground)
  - Unattended sensors
  - Inefficient management/ distribution of power
  - Demand for soldier-wearable power
- Increased emphasis on system power metrics (KPPs, low consumption components)



## The US: Our Increasing Reliance on Fossil Energy Imports



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## Strategic Energy Security Goals (ESGs)

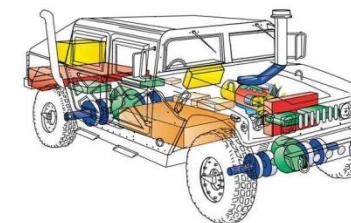
**ESG 1:** Reduced energy consumption.

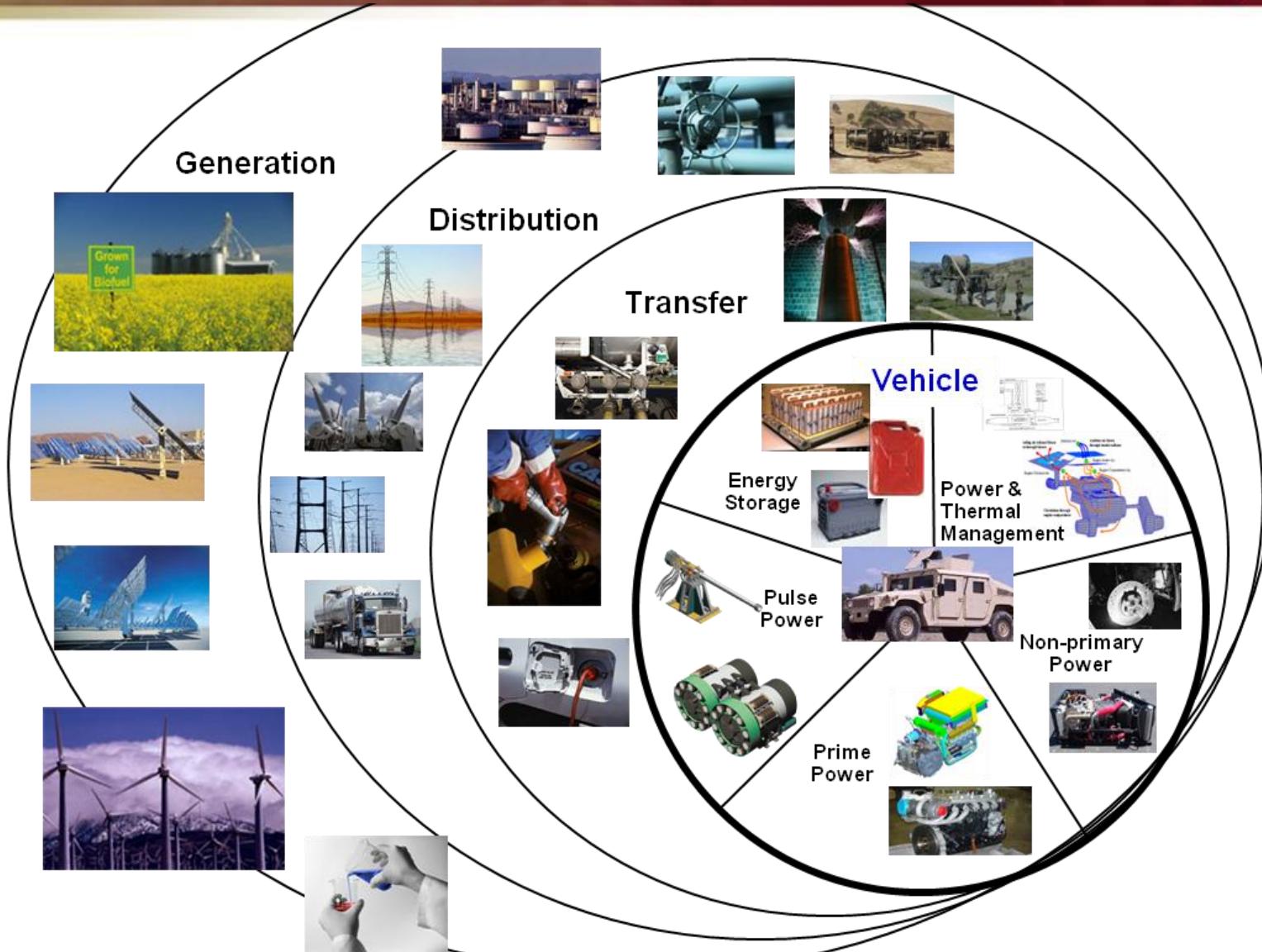
**ESG 2:** Ensuring resilience in energy systems.

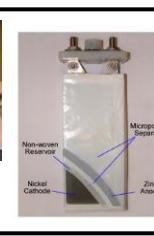
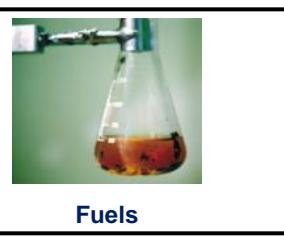
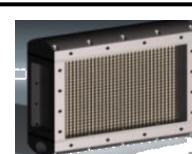
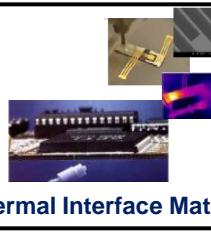
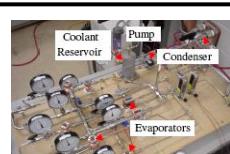
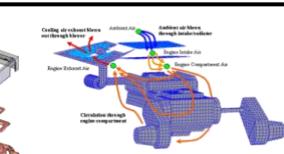
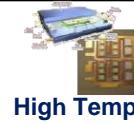
**ESG 3:** Increased use of renewable/alternative energy.

**ESG 4:** Assured access to sufficient energy supplies.

**ESG 5:** Reduced adverse impacts on the environment.



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Power Generation	 Diesel Engines	 Transmissions	 Traction Motors	 Integrated Starter Generator	 Turbine Engines	 Drivelines
Energy Storage	 Li-ion / Ultracap Hybrid Energy Storage	 Capacitors	 Advanced Batteries	 Advanced Batteries	 Advanced Batteries	 Fuels
Thermal Transport & Distribution	 Radiators	 Thermal Interface Materials	 Heat Recovery	 Phase Change Cooling	 Advanced Electronics Cooling	 Thermal Architectures
Power Control & Distribution	 Power Controllers for Power Management	 Power Converters/Inverters	 Wide Band Gap Materials (SiC)	 High Temperature SiC Modules	 Pulse Power Switching	 High Temperature Capacitors
Track & Suspension	 Track Systems	 Suspension Systems	 Electronic Stability Control	 Elastomer Research	 Elastomer Research	

TECHNOLOGY DRIVEN WARFIGHTER FOCUSED.

- Propulsion Laboratory
  - Engine Dynamometer Test Cells
  - Power and Inertia Simulator (PAISI) Test Cell
  - Vehicle/transmission/drive axle Evaluation Test Cell
  - Single-cylinder Engine Research Test Cell
  - Engine Generator Test Lab
- Full Vehicle Environmental Test Cell
- Hybrid Electric Reconfigurable Moveable Integration Testbed (HERMIT)
- Electro-chemical Analysis and Research Lab (EARL)
- Battery Lab
- Air Flow/Cooling Lab
- Electrical Power Architecture Systems Integration Lab (SIL)
- Ground Systems Power & Energy Labs (GSPEL)



Propulsion Lab



Electrical Power  
Architecture SIL



Airflow/Cooling Lab



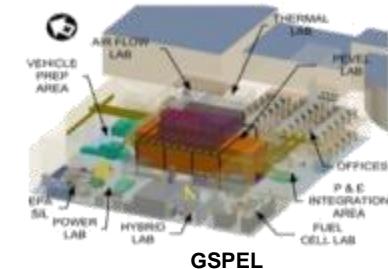
Battery Lab

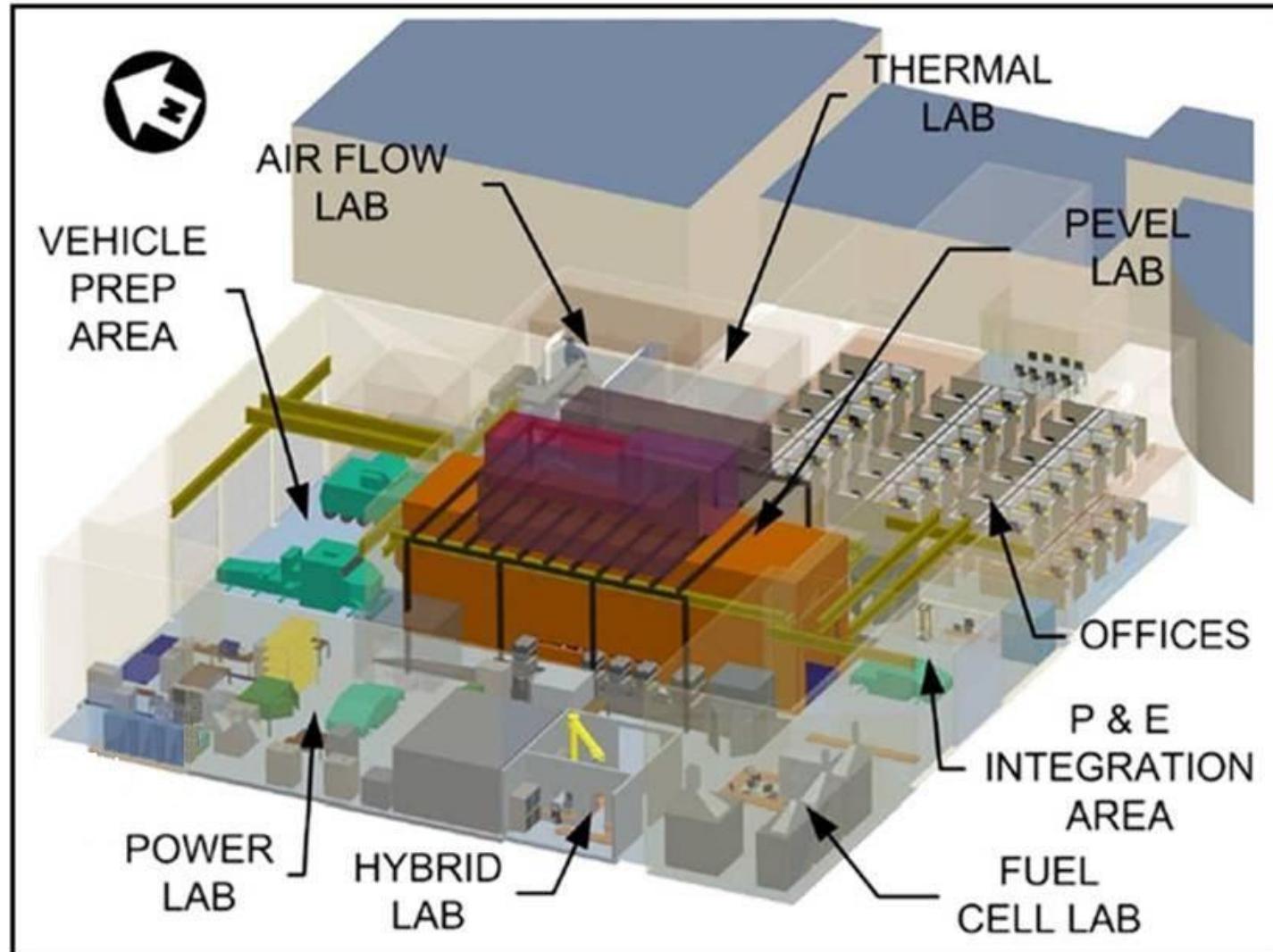


HERMIT



Environmental Test Cell





# It's all about...Supporting the Warfighter

